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The pyrolysis behavior of crude oil sara fractions and the effect of pressure on characterized by differential scanning calorimetry (DSC)

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Abstract

© SGEM2018. In-situ combustion is an effective enhanced oil recovery (EOR) method for heavy oils. Whether an in-situ combustion process can be applied successfully or not depends on how the combustion process of crude oil behaves in reservoir after air injection. The oxidation process of crude oil in the reservoir is always accompanied with the pyrolysis process. Therefore, it is very essential to investigate the pyrolysis behavior of crude oil. However, the composition of crude oils is very complicated, which makes it difficult to clearly understand the pyrolysis mechanism. Therefore, in this study, we separated the crude oil into SARA fractions, and investigated their pyrolysis behavior in nitrogen atmosphere by differential scanning calorimetry (DSC) experiments. Simultaneously, the effect of pressure on the pyrolysis behavior was also studied by high-pressure differential scanning calorimetry (HP-DSC). The results showed that the pyrolysis process of SARA fractions except saturates can be divided into two stages. The first stage is the evaporation of light fractions with low boiling point and the rupture of some weak chemical bond. And the second stage is the main cracking stage where the complex reactions occurred, such as the cleavage of the C−C bonds in alkanes and alkyl side chains attached to naphthenic rings, and finally the coke was formed. For the saturates, the second stage is not obvious. The pressure had a significant influence on the pyrolysis process of the saturates. The increase of the pressure improved the cracking reactions by inhibiting the evaporation of the saturates. However, the pressure had a small effect on the pyrolysis process of asphaltenes.

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Keywords

Crude oil, In-situ combustion, Pyrolysis, SARA fractions

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